

REMARKS

Status of Claims

Claims 1-25 are pending in the present application. In the outstanding Office Action, claims 1-25 have been rejected under 35 U.S.C. § 103, and § 112, first paragraph.

In the amendment submitted herein: claims 1, 3-4 and 15-16 are canceled, and claims 2 and 14 are amended. No new matter has been introduced as support for the amendment is found in the originally filed claims and specification. Accordingly, entry of the amendment is respectfully requested.

Rejection under 35 U.S.C. § 112, first paragraph

Claims 1-25 have been rejected under 35 U.S.C. § 112, first paragraph, as failing to provide an adequate written description and failing to provide an enabling disclosure. Specifically, the Examiner states that the distances as set forth in the claims are open ended and may even be infinity.

Applicants herein cancel claim 1 and amend claims 2 and 14 to define the distances, R1 and R2, in a specific range. Support for the amendment is found in the originally filed claims, specifically claims 3-4 and 15-16, and in the specification, specifically, page 18, line 10, page 14, line 21 and page 30, Table 2.

For the distances, R1 and R2 defined in a specific range, the specification sufficiently meets the written description and enabling disclosure requirements.

Accordingly, the rejection under 35 U.S.C. § 112, first paragraph has been completely addressed. Reconsideration and withdrawal of the rejection of claims 2, 5-14 and 17-25 is respectfully requested.

Claim Rejection – 35 U.S.C. § 103

The Examiner has rejected Claims 1-25 under 35 U.S.C. § 103(a) as being unpatentable over Catlin (U.S. Patent No. 2,650,308). The Examiner states that Catlin describes the phenomenon of magnification that occurs in x-ray imaging and further reveals that radiography may comprise any number of combinations of object to source distance and object to detector distance.

In claim 2, Applicants recite an X-ray image radiographing method. Applicants teach using an X-ray tube having a size D of focal spot, $30 \mu\text{m} \leq D \leq 1000 \mu\text{m}$. Also, Applicants teach setting a distance R1 between the X-ray tube and an object as being within a range defined by the formula: $(D-7)/200 \text{ m} \leq R1 \leq 10 \text{ m}$, and setting a distance R2 between the object and an X-ray detector as being within a range defined by the formula: $0.15 \text{ m} \leq R2 \leq 1.4 \text{ m}$.

In contrast, Catlin teaches a method of measuring the true size of organs or objects photofluorographically recorded. Catlin is moot with regard to a size D of focal spot of an X-ray tube. Catlin fails to teach the relationship between the size D of focal spot of the X-ray tube and a distance R1 between the X-ray tube and an object.

To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. MPEP § 2143.

However, as apparent from the above analysis of the Catlin reference, all the limitations of claim 2 are not taught or suggested by Catlin.

Further, there is no suggestion or motivation, either in the reference itself or in the knowledge generally available to one of ordinary skill in the art, to modify the reference teachings to make the claimed invention.

The claimed invention is directed to resolving a penumbra caused by inappropriate size "D" of focal spot (page 13, lines 11-15).

The size of the focus point represented as "D" is measured from a half-width in the intensity distribution of the radiation source (page 11, lines 20-23 of the specification). In the claimed invention, the penumbra or blur phenomenon is prevented by adjusting the size of the focal spot of the X-ray tube along with the distances between the object and the X-ray tube and between the object and an X-ray detector, as recited in claim 2. As a result, the contrast at boundary surfaces differing refractive index for X-ray in the object can be enhanced (page 20, line 17-19 of the specification).

In contrast, according to the method of Catlin, an organ or object is first shown enlarged by projection of a divergent light beam 13 from an X-ray tube 7 onto a fluorescent screen 8 and then be reduced by a camera 9 onto a small size record film at 10 (Figure 1 and column 2, lines 15-20). In order to provide a standard of measurement, Catlin teaches that a measuring scale of selected form is exposed in an object plane and reduced on a record film under exactly the same conditions as the object in examination (column 2, lines 32-37). Also, Catlin teaches that the extent of successive enlargement and reduction depends on several factors such as the distance of the object from the screen, the distance of the X-ray tube from the object and the ratio of reduction effected by the camera.

In light of the foregoing, Catlin is silent with regard to a size of focal spot of an X-ray tube. Catlin does not identify the problem of blur or penumbra. In this respect, Catlin is clearly distinguished from the claimed invention in the aspect of the problems to be solved.

Thus, the reference clearly does not suggest modification thereof or combination with other references to form the claimed invention.

Moreover, there is no reasonable expectation of success in making the claimed invention by modifying reference teachings, because Catlin clearly fails to teach the size of focal point of the X-ray tube and the distance between the object and the X-ray tube as set forth in claim 2 in order to enhance edge image of the object.

For at least the foregoing reasons, Applicants respectfully submit that a *prima facie* obviousness does not exist with regard to claim 2. Accordingly, claim 2 is non-obvious over Catlin.

Claims 5-13 variably depend from claim 2 which is now believed to be an allowable independent claim. Therefore, claims 5-13 are inherently allowable.

Meanwhile, in claim 14, Applicants recite an X-ray image radiographing apparatus, comprising an X-ray tube, a fixing means, and an X-ray detector. The size "D" of focal spot of the X-ray tube, the distance between X-ray tube and the position of an object fixed by the fixing means, and the distance between the position of the object X-ray detector are recited as being the same as those recited in claim 2.

Therefore, for the same reasons as discussed with regard to the rejection of claim 2, claim 14 is not rendered obvious by Catlin.

Claims 17-25 are recited as being dependent upon claim 14. Therefore, claims 17-25 are now believed to be allowable as depending from the allowable independent claim 14.

For at least the foregoing reasons, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 2 and 5-14 and 17-25 under 35 U.S.C. § 103(a).

Conclusion

As discussed above, claims 2, 5-14 and 17-25 are not anticipated nor rendered obvious by Catlin reference relied upon by the Examiner because all the limitations of the claimed invention are not taught or suggested by the reference. Therefore, the obviousness rejection of claims 2, 5-14 and 17-25 are improper. Reconsideration and withdrawal thereof is respectfully requested.

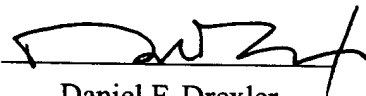
It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims are allowable to Applicants. Accordingly, reconsideration and allowance of all the pending claims is requested.

The Examiner is invited to contact Applicants' attorney at the below-listed phone number regarding the present response or otherwise concerning the instant application.

If there are any charges due with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130 maintained by Applicants' attorneys.

Respectfully submitted,
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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claims 2 and 14 are amended herein as follows.

2. (Amended/Marked up) An X-ray image radiographing method, comprising [steps of]:

using an X-ray tube having a size D of focal spot [of 30 μm or more] defined by the following formula:

$$\underline{30\ \mu\text{m} \leq D \leq 1000\ \mu\text{m};}$$

setting a distance R1 between the X-ray tube and an object so as to be within a range defined by the following formula:

$$[R1 \geq (D-7)/200\ (\text{m})]$$

$$\underline{(D-7)/200\ \text{m} \leq R1 \leq 10\ \text{m}; \text{ and}}$$

setting a distance R2 between the object and an X-ray detector so as to be [not smaller than 0.15 (m)] within a range defined by the following formula:

$$\underline{0.15\ \text{m} \leq R2 \leq 1.4\ \text{m}.}$$

14. (Amended/Marked up) An X-ray image radiographing apparatus, comprising:
an X-ray tube having a size D of focal spot [of 30 μm or more] defined by the following
formula:

$$30 \mu\text{m} \leq D \leq 1000 \mu\text{m};$$

a fixing means for fixing a position of an object to be radiographed; and

an X-ray detector to detect an X-ray image [passing] having passed through the object;

wherein the fixing means is able to set such that a distance R1 between the X-ray tube
and the position of the object fixed by the fixing means so as to be within a range defined by the
following formula:

$$[R1 \geq (D-7)/200 \text{ (m)}]$$

$$(D-7)/200 \text{ m} \leq R1 \leq 10 \text{ m}; \text{ and}$$

a distance R2 between the position of the object fixed by the fixing means and an X-ray
detector so as to be [not smaller than 0.15 (m)] within a range defined by the following formula:

$$0.15 \text{ m} \leq R2 \leq 1.4 \text{ m}.$$